

Chapter 6. INSTITUTIONAL STRUCTURE TO IMPLEMENT CMARP

INTRODUCTION

The CMARP Phase 1 report states that the Steering Committee will develop recommendations for creating an institutional structure to implement the CMARP over the long-term. These recommendations would emphasize flexibility. They would be made after review of the strengths and weaknesses of large scale environmental monitoring programs both locally and around the country, after consulting with the agencies and stakeholders involved in CALFED and the organizations that would be expected to participate as partners within CMARP. While progress has been made in reviewing large-scale environmental monitoring programs and in consulting with participating agencies, partner agencies and stakeholders, these external evaluation and consultation processes have not been completed. Thus, the recommendations of this Chapter are considered preliminary.

The characteristics or attributes CMARP participants believe that the program should display and the functions they believe the structure needs to perform are listed. This Chapter describes the elements needed of a management structure to ensure that the functions are carried out and the processes that the structure will need to implement to ensure that the attributes are obtained. Largely because the long-term arrangements for the implementation of the CALFED program have not yet been determined, CMARP participants believe that the final form of the CMARP Institutional Structure cannot be resolved at this time. Issues upon which additional input would be helpful have been identified.

Because of the uncertainty about the long-term CALFED Institutional Structure, this Chapter uses several terms, which need definition. It is presumed that there will be some CALFED sanctioned body to which

the CMARP will report and from which it will receive direction and funding authorization. This body might be a continuation of the current policy group, a newly comprised Board, an existing agency or a new organization. This institution is referred to as the **Decision-making Body**, and the long-term monitoring, assessment and research program is referred to as *CMARP*. Use of this term does NOT imply that it is organized and governed in the same fashion as the CMARP Steering Committee used for Phase II. The term **Monitoring, Assessment and Research Organization (MARO)** is used, loosely, to cover any possible arrangement, from an interagency working group to a newly formed Institute; it is the organization that will be responsible for implementing CMARP. *The CMARP Team* refers to all scientists and other personnel working on CMARP, including those formally within the MARO, and in the larger body of CMARP participants and contractors.

ATTRIBUTES OF A CMARP INSTITUTIONAL STRUCTURE

Discussions among the workgroup participants and with those interviewed led to the conclusion that certain principles or primary sets of attributes ought to underlay all deliberations on institutional structure for the program. Any recommended institutional structure for CMARP must address these principles.

Responsiveness to Management Needs--

The primary purpose of CMARP is to provide the information and scientific interpretations and advice necessary for CALFED to fully implement its preferred alternative, including the common programs, and for the public and government agencies to evaluate the success of CALFED. The ability of the program to provide the kind of information needed by managers as they move forward

through the decision process is, therefore, paramount. The types of management needs to which the CMARP must respond include:

- documenting compliance with regulatory standards,
- detecting and reporting trends in environmental condition,
- measuring CALFED program performance,
- providing timely information for decisions, and
- collaborating with management to execute active adaptive management.

Scientific Quality – The importance and cost of the decisions to be made in the CALFED process and the demands of the adaptive management require that these be based upon the best scientific information that can be made available. CALFED managers need to be assured that the scientific work they are funding, and upon which they will be relying, is of the highest quality possible. Quality will be enhanced by:

- Scientific competence and credibility achieved through publication of results in peer-reviewed scientific journals.
- Scientific breadth and depth resulting from a broad mixture of disciplines and expertise represented in the MARO and the CMARP Team.
- Independence such that CMARP scientists have the ability to determine how best to do their work and be free of attempts to influence their findings, achieved at least in part by extensive use of external scientific review.
- Commitment to long-term monitoring, assessment and research to reduce uncertainty.

Accountability -- Accountability encompasses responsiveness and quality, but also includes the concepts of cost-effectiveness, transparency of process, and participation. There appears to be strong support for a substantial increase in funding for monitoring, assessment and research. With additional funding is an

increased sensitivity to accountability, which requires:

- easy access to all of the data and information upon which decisions are based.
- collaboration among scientists, stakeholders and resource managers.
- an open, consistently applied and transparent process for setting program priorities and making funding decisions.
- cost-effectiveness achieved by building upon existing programs and by employing competitive solicitation processes.

Some of these attributes stand in opposition to each other. For example, independence implies an absence of control while responsiveness requires a degree of control over program decisions. Over-emphasis on cost-effectiveness may threaten commitment to scientific excellence. Responding to urgent management needs could threaten the commitment to long-term monitoring. The greatest challenge in the implementation of CMARP will be to achieve the appropriate balance among these competing principles.

FUNCTIONS OF THE CMARP INSTITUTIONAL STRUCTURE

Perhaps the first question to address in considering an institutional structure for implementation of CMARP is what it is that CMARP must do for CALFED. The CALFED Decision-making Body will need information to answer short-term questions before proceeding with the staged decision-making process, and measurement of the long-term conditions in the Bay-Delta and associated performance measures to determine whether individual projects initiated by the common programs are successful and whether the problems of the Bay-Delta are being solved. The principle function of CMARP is, therefore, to manage the direction of the monitoring, assessment and research program to provide this essential information.

CMARP will also be the scientific arm of CALFED and will be prepared to assist in the design of the adaptive management program. This assistance must come from individuals who understand experimental design and the design of field programs. In addition to analyzing trends, CMARP must be prepared to initiate scientific research, including monitoring, modeling, and data analysis, to determine whether things are changing and what effect the CALFED actions have had. Although this will not always be possible, it should be the idea behind all of the performance assessment.

The functions that the institutional structure created for CMARP must carry out include the following:

- designing and directing the monitoring, assessment and research program,
- collecting, managing and distributing data,
- analyzing and interpreting data, and reporting the findings,
- orchestrating external scientific review of projects and programs, and
- collaborating with management on adaptive management.

It is assumed that some new core organization or organizations would need to be created, whether through formal or informal means, to serve as the recipient for CALFED funding and to serve as the focal point for accountability. These general functions require that several tasks be carried out by the MARO and some by the broader additional array of individuals and organizations that make up the CMARP Team. The Structures and Processes discussed below illustrate by whom and how these functions might be carried out.

ELEMENTS OF THE INSTITUTIONAL STRUCTURE

Given the need for the functions described above, certain elements of an institutional structure will be needed. The following elements will serve to increase the

probability that the Monitoring, Assessment and Research Program will achieve the desired attributes and can fit into any number of structural approaches. These elements collectively would comprise the MARO:

1. Science Review Board, advisory to highest Decision-making Body for CALFED.
2. A highly visible position of Chief Scientist with direct access to decision-makers.
3. A highly qualified team of scientists and support staff to assist and advise the Chief Scientist, which is referred to as the Core Technical Staff.
4. A Science Coordination Team, made up of individuals from the agencies and organizations responsible for implementing major elements of the monitoring, assessment and research program.

Science Review Board -- The Science Review Board will play an important role in guiding the Decision-making Body with regard to its use of science in adaptive management and decision-making. Because science inherently produces uncertain results, often complicated by contentious debate among conflicting interpretations, the Decision-making Body may need assistance in understanding the quality and usefulness of the information upon which they are asked to make decisions. The Science Review Board will help the Decision-making Body make these judgments. The Science Review Board will also assist in using scientific information to evaluate whether the CALFED program is reaching its dual goals of improving water supply and restoring the Bay-Delta ecosystem. It would ask such questions as "Is the condition of the Bay-Delta system improving?" "Is the CALFED program using adaptive management experimentation effectively to reduce uncertainty and improve management?" This level of review addresses not the quality of the

scientific program *per se*, but the use of science in the management program.

The Science Review Board should include a combination of prominent scientists who have expertise in CALFED-type programs and issues, but do not work in the area, and prominent scientists with local experience and expertise who are independent of CALFED agencies and stakeholders.

The development of the Science Review Board needs to provide both for some stability and for turnover and fresh ideas and viewpoints. Staggered terms of 3-5 years would provide this. The Board needs both to be allowed the highest degree of independence, yet be able to work closely and hold the trust and respect of the CALFED Decision-making Body. It is suggested that professional societies such as the American Fisheries Society, the Estuarine Research Federation, the National Academy of Sciences, the National Science Foundation, or the Wetlands Society would make nominations to the Board. The Board should select new Board members itself; it should be self-renewing. The Decision-making Body should have the power to veto a proposed nominee, but not to make the selection. This leaves the question of the original selection of the Board. The solicitation of an original slate of candidates could be contracted to the National Academy of Sciences or some other well-respected and neutral group of eminent scientists.

Since the primary source of information for the Science Review Board will be CMARP, judgments on the quality, breadth, and applicability of the work done by CMARP will, to some extent, be a necessary by-product of the Science Review Board's principle role. The Decision-making Body may also look to the Science Review Board for assistance in evaluating the quality and effectiveness of CMARP. Since this exercise will, to a degree, involve evaluation of the talents and judgment of the Chief

Scientist and the Science Coordination Team that reports to the Chief Scientist, an arm's length relationship between the Board and the Chief Scientist should be maintained.

Chief Scientist -- Scientific leadership is key to the success of CMARP, and is more important than any other aspect of the organizational structure set up to operate or govern the program. While it is possible that this leadership will emerge from within the agencies and organizations that will be participating in CMARP, or from a coordinating committee created to guide CMARP, it is just as likely that it will not. An endeavor of the magnitude and importance of CMARP must have strong leadership. Providing a position of Chief Scientist will help ensure high levels of credibility and accountability. Regardless of the particular arrangement chosen, numerous individuals, agencies, and organizations will be involved in CMARP. Without a central figure charged with making the program work and producing results, it will be very difficult to determine where responsibility for problems or deficiencies in the program lies.

This individual will need the breadth and depth of understanding of environmental and related sciences to be able to fashion a program that entails all of the subject matter described in other sections of this report. He or she will need to have the credibility and enthusiasm to inspire the confidence of all of the scientific personnel working on CMARP, whether or not those scientists work directly for him or her. He or she must be able to identify and draw upon the expertise of scientists from around the country as well as those locally to assist in peer review and external review processes. This individual will need extraordinary communication skills in order to understand the needs of decision-makers, relay scientific findings to them in understandable terms, and communicate with public audiences and scientists from a variety of disciplines. He or she must be able to

simultaneously speak the truth and maintain the trust and confidence of all of the stakeholders. Finally, he or she must be at least a bit of an iconoclast, and be willing to challenge the paradigms that influence our current understanding of the Bay-Delta system.

The Chief Scientist will report to the head of the agency or organization in which his or her position resides and also directly to the CALFED Decision-making Body. Duties of the Chief Scientist will include the following:

1. Be responsible for the overall direction and quality of the monitoring, assessment and research program.
2. Assemble and direct a *Core Technical Staff* that can provide the type of analysis and interpretation of monitoring information discussed in Chapter 5.
3. Chair a *Science Coordination Team* designed to keep all of the agencies and organizations that implement elements of the program working collaboratively.
4. Identify (through communication with the Decision-making Body, Science Review Board, Stakeholder Advisory Committee, etc.) the management issues that need to be addressed through CMARP.
5. Identify and help resolve technical controversies, through consensus building, where possible.
6. Produce an annual work plan of monitoring, assessment and research to be approved by the Decision-making Body.
7. Ensure that the external review functions are carried out, supported, and heeded.
8. Convene an Annual Science Conference.

The Chief Scientist has the ancillary duty of interacting with the regulatory agencies. There is a feedback loop with the regulatory agencies such that regulatory monitoring might be improved, and the information produced feeds and affects the regulatory process.

Core Technical Staff -- A team of individuals to assist the Chief Scientist as a core staff needs to be assembled. The Chief Scientist should have a fairly free hand (subject, of course to budgetary limitations) in assembling this team; he or she ought to be able to 'recruit' from within agencies (as well as from external organizations). This team would advise and assist the Chief Scientist in

- developing the annual work plan to address monitoring, assessment and research needs,
- help to develop and lead research programs in conjunction with extramural researchers,
- form working teams to operate monitoring programs which are largely agency-conducted,
- nurture partnerships with scientists in other research organizations,
- critically review and analyze CALFED- and non-CALFED-funded monitoring-program data,
- work with data generators to interpret and produce publishable findings based on current data, and
- report periodically and as needed to the Decision-making Body and the public.

This team will consist of a number of highly qualified scientists representing a broad array of expertise in the environmental sciences. It would be desirable to have a mix of individuals that includes some that have extensive experience within the Bay-Delta system and that have developed relevant expertise working in other systems, and some that are well-established in their fields and others who are at the beginning of their careers. One way to ensure that a continual stream of new thinking and approaches flows into the Core Technical Staff would be to assign a number of time-limited postdoctoral positions to the team. The scientific staff would also need various forms of support, including technical, data management, graphics, and administrative.

Science Coordination Team – The agencies and organizations (including stakeholder organizations) that currently conduct major monitoring, assessment and research programs will need to play an important role managing the comprehensive program proposed by this document. These are the programs upon which CMARP will need to be built. The comprehensive program will result from the combination of these programs and the new efforts initiated in directed response to CALFED needs. In some cases, especially where expansion or redirection of existing efforts is required to make the CMARP program work, these same agencies and organizations will need to be involved in helping to craft the changes and will need to be conducting additional work. This team will be the mechanism by which the Chief Scientist keeps all of these efforts moving in a coordinated fashion, and ensures cooperative working relationships among all of the partner organizations within the CMARP Team. The team will be responsible for helping to develop the annual work program for CMARP. Because each of the elements of the CMARP program will undergo periodic review, the membership of this team will have to be kept flexible, allowing for adding new members when a new player is identified, or dropping off an organization that no longer is playing a pivotal role.

PROCESSES

There are several processes by which the structures described above will carry out the functions of CMARP. Commitment to these processes is as important to the success of CMARP as the structures set up to operate them. Critical processes include:

1. control of money flow and budgeting of funds,
2. external scientific review of programs, proposals, and products,
3. partnerships between internal and external scientists, management,

4. science management partnership for adaptive management,
5. resolving technical conflicts
6. data collection, data management and information handling,
7. annual Science Conference, and
8. stakeholder advisory mechanisms.

Control of Money Flow and Budgeting of Funds – The MARO will need to serve the function of distributing the funds allocated for research and monitoring and accounting for the funds and the work done. To ensure accountability and to give CMARP the opportunity to have a coherent program, it will be desirable for the flow of money to CMARP for the CALFED funded portion of the program be directly from the Decision-making Body to the organization that houses and provides administrative support to the Chief Scientist. The MARO should have the authority to make grants and contracts and should be provided with the necessary administrative support.

CMARP will have to continually undergo evaluation and adjustment to ensure that it is accomplishing its goals. This future development will have to take place within the MARO. While the program activities should be planned on a multi-year basis, there will be an annual budgetary cycle for CALFED appropriations. CMARP will have to be translated into annual work plans (that would contain the annual increment of multi-year monitoring and research elements) each year so that it can be submitted to the Decision-making Body for review, approval and funding.

Some limitations should be set on the way the total amount of funding available for monitoring, assessment and research is spent. First, it is clear from the remainder of the CMARP report that monitoring, assessment, and research will be needed. It would be counterproductive to make dramatic shifts year to year in the proportion of funding between these three major activities. Over time, as understanding of

the system increases and monitoring methods become more efficient, there may be a gradual shift to providing a larger portion of the funding to assessment and research. It will also be important to reserve some portion of the budget for "urgent management needs". From time to time, unanticipated situations will occur that may demand an immediate response by mobilizing special studies to enable rapid response to acute management issues. This should be taken into account during budget planning such that CMARP can respond quickly to such situations without causing irreparable harm to long-term trend monitoring or multi-year research programs that have already been put into place. A goal should also be set for a continuing, significant proportion of funding to be spent externally to the MARO in grants to researchers in universities, non-governmental organizations and the private sector.

External Scientific Review – The credibility, quality and timeliness of the external review of the science used by and produced by the CALFED program is key to achieving numerous desired attributes. It will be essential to assure that funds are effectively spent, that information produced is of high quality, that the program is responsive to management needs, and that the program does not become insular but remains open to new ideas. Such review is required at three points in the development and implementation of the program:

1. review of the overall direction and quality of CMARP,
2. selection of research proposals and monitoring program elements, and
3. review of CMARP products.

Program Review

External program review involves review of the overall quality and direction of CMARP. It addresses the questions "is CMARP providing the scientific information needed for CALFED management decisions?" "Is it asking the right questions?" "How well can

it answer these questions?" The Chief Scientist may wish to form one or more expert external review panels to delve in depth into questions about the program as a whole, or about a specific program element. It may be desirable, for example, to call a panel of experts on fish population dynamics to advise the MARO and to review how well CMARP is monitoring fish populations. The Chief Scientist may also choose to make use of intensive workshops to address a specific issue. For example, if the CMARP funded several years of research exploring Fish-X2 relationships, the Chief Scientist might want to organize a workshop involving local researchers who had been working on these problems and a number of outside experts to address 1) whether the questions had been solved sufficiently, 2) whether additional resources should be applied to the problem, and 3) directions that future research effort ought to take.

Proposal Selection

The CMARP work program will involve work done internally by its Core Technical Staff, work done by agencies and organizations participating on the Science Coordination Team, work done externally by universities, agencies, non-governmental organizations, and the private sector, and projects involving collaboration among parties "internal" and "external" to the CMARP Team. It will involve a combination of monitoring program elements, research projects, and projects involving original approaches to assessment of existing data sets. The Chief Scientist will need to develop processes that ensure that ALL projects and program elements funded by CALFED would be subject to essentially the same proposal solicitation and review process, regardless of source. To do this will require instituting an objective process for the anonymous peer evaluation of proposals for new monitoring, assessment and research that is efficient and achieves broadest acceptance of the process within the CALFED community.

- *Research Proposal Solicitation*—A list of approved management and study questions will be developed by the Chief Scientist, Core Technical Staff, and Science Coordination Team with input from managers, field scientists, and stakeholders. The Chief Scientist would prepare one or more Proposal Solicitation Packages designed to solicit proposals for addressing the identified study questions. The Proposal Solicitation Packages would be designed to allow for and encourage multi-year, collaborative projects. The solicitation process will also provide for projects that might be termed assessment, in that they may be focused on original analyses of existing data rather than original fieldwork. The Chief Scientist will also recommend the criteria to be used in proposal evaluation.
- *Proposal Review Process*—It will be the job of the Chief Scientist to see that appropriate and qualified reviewers are identified and that the process is done professionally. The Chief Scientist will rely upon a two-tiered review system:
 1. a Peer Review Coordination Panel with members reimbursed for their time, and
 2. a large group of pre-qualified technical experts who provide the first level of anonymous review (these reviewers will be offered honoraria for their services).

The Peer Review Coordination Panel would comprise a group of 10-15 technical experts, nominated by the MARO. The members should be active estuarine, freshwater, fisheries, wildlife, or watershed research scientists/engineers who have a high degree of stature, are well connected with other scientists in their respective fields, represent different specialties within these fields, and have some familiarity with the San Francisco Bay-

Delta watershed system. The Chief Scientist would ensure that Peer Review Coordination Panel members have no conflicts of interest (e.g., current or pending support from the Program or personal or institutional stake in the outcome).

The members of the Peer Review Coordination Panel will be tasked with soliciting and overseeing the anonymous external (mail) review of proposals. Each member will solicit reviews by at least three experts for each proposal within his/her specialty areas, then summarize and prioritize the member's findings for presentation to the other members of the Panel. Reviewers will score the proposals, based on their scientific merit and the relevance to the Proposal Solicitation Package. When all reviews have been received, the proposals will be ranked by the Peer Review Coordination Panel based on the external mail reviews and the Panel's own evaluation. The Peer Review Coordination Panel will develop an overall prioritization of the proposals and will make funding recommendations to the Chief Scientist for his or her review of the recommendations. Until the Decision-making Body is constituted, the Chief Scientist will submit the CMARP annual work program to the CALFED Integration Panel for approval.

The Peer Review Coordination Panel will be modeled after that used by the Exxon Valdez Restoration Program. In the Exxon Valdez Program, the Peer Review Panel meets annually for several days to review the entire annual program, including progress on multi-year projects and all of the new proposals that have been submitted for funding. Reviewers serve for several years, allowing them to become familiar with the goals and management needs of the program's decision-makers and

the strengths and weaknesses of the monitoring, assessment and research programs. In addition to passing judgment on individual projects as proposed, they make suggestions to augment weak but high priority projects by combining projects, bringing in additional experts to assist in certain projects, and suggesting how to redesign certain projects for future reconsideration. In this fashion they help to ensure that the proposal solicitation, review and selection process results in a coherent program of research rather than a collection of disparate projects.

- *Monitoring Proposal Solicitation—* Because monitoring elements may continue for a number of years with little change, it may be necessary to develop a different schedule for review of the monitoring elements of the program and the research and assessment elements. Thus, major elements of the monitoring program might be resolicited on a five-year cycle. The Chief Scientist would direct preparation of proposal solicitation packages seeking applicants from public and non-profit agencies, the private sector, and academia. The package would describe data collection standards, quality assurance procedures, and data delivery requirements. The Peer Review Coordination Panel would rank applicants on the basis of their qualifications and demonstrated performance, availability of required equipment and permits, the effectiveness of data collection plans, and proposed cost. The Chief Scientist would select a proposed grantee from applicants with high rankings to include within the recommended work program that would be submitted to the CALFED Decision-making Body. Grantee performance would be evaluated annually based on quality and timely

delivery of data prior to renewal of the grant.

Review of CMARP Products

Review of completed projects addresses the quality of the products produced. It asks the question, "Was the work done in a scientifically credible manner?" The ultimate process for doing this will be the peer review process that attends publication of the results in scientific journals. Another, more preliminary step will need to be provided. Getting papers published in peer reviewed literature typically takes two years or longer; CALFED managers will often want or need the information produced, including an assessment of the quality of the information, much faster than that. The solution may be a process similar to that used by the South Florida Water Management District. They have set up their own quick turn-around peer review process. A large slate of pre-qualified external reviewers are available who can provide thorough peer review on a fee-for-service basis in a very short time frame. This process serves the dual purpose of providing the managers with information that they are assured is of high quality in a reasonable time frame and increasing the success of District employees in publishing their papers. This same system could be applied to any information product produced by CMARP, even if it were not destined for publication in the peer-reviewed literature. However, as a matter of principle, we recommend that the program results be published to the extent practicable.

CMARP participants are aware that no peer review process is without flaws, and that peer review and publication will not resolve all issues of quality and credibility. Nor is it meant to be suggested that scientific work that has not been reviewed is by definition of poor quality. Rather, it is believed that a commitment to extensive impartial review will add credibility to good work already being done and will tend to raise the standards for work done and will increase

the overall perception of quality and credibility of the entire program. Extensive peer review as suggested here will require the commitment of substantial funding and staff support; without this support it is unlikely to achieve its purpose.

Partnerships between Internal and External Scientists

These partnerships comprise the CMARP Team and are based upon collaborative working relationships between and among the Chief Scientist, the Science Coordination Team and the agencies and organizations conducting CALFED funded AND non-CALFED funded environmental monitoring, assessment and research. The CMARP inventory of monitoring programs for the Bay-Delta and its tributary rivers shows the tremendous breadth and depth of the monitoring programs currently in existence. Many individual scientists in universities and other institutions are carrying out research relevant to CALFED needs, independent of these monitoring programs. While many of these efforts are not directly related to CALFED, a large number are producing data and information that is of tremendous value to CALFED, and may form a large portion of the comprehensive program that CMARP proposes. Upon this existing framework, the CALFED funded monitoring, assessment and research program will be superimposed. A large part of the challenge of implementing CMARP will be to knit together these disparate programs and determine where the most value added will result from an expenditure of CALFED funding.

A network of data sharing and research collaboration and an attitude of common purpose amongst all of these organizations would serve CALFED well. The Chief Scientist and the Science Coordination Team could help to create such a network and multiply the effectiveness of their funding through a variety of means. Applying the same review process to

internally and externally funded work is one such means, and providing extra-mural funding will be another. The program should seek additional means of creating incentives for participation in and cooperation with CMARP. If this is done, a much larger virtual organization comprising much more effort and expertise than CALFED could ever pay for will materialize. If the MARO becomes known for its stature and professionalism, other organizations will want to associate themselves with it. It is further possible that if the MARO establishes very high standards of performance, and funds projects and programs of those agencies and organizations that meet those standards, it can create a situation in which all of the agencies and organizations working in the Bay-Delta strive to meet that standard. This would have a positive influence on the quality of all of the environmental monitoring, assessment and research done in this region. (This has been the experience of the *Exxon Valdez* Oil Spill Restoration Program.)

Science-Management Partnership to Carry Out Adaptive Management

Active adaptive management, if employed by CALFED, will require a partnership between decision makers, stakeholders, managers of the natural resources, and scientists. In particular, this will mean bringing those responsible for the common programs together with the Chief Scientist and the Teams that assist him or her. This partnership is necessary because policy makers and stakeholders will have to be willing to take short-term risks with the resources, the resource manager will have to negotiate necessary agreements to acquire the resources, and scientists will have to design experiments using the resources. Successful adaptive experiments reduce long-term risks to resources by taking carefully designed, short-term risks. Adaptive experiments often focus on unusual conditions, and

thereby accelerate the rate of learning beyond what would naturally occur.

CMARP recognizes that while scientific input is vital in the process of proposing and carrying out adaptive management experiments, final decisions upon whether such experiments are carried out will, in each individual case, be made by resource managers, not scientists. Passive adaptive management and other means of modeling and experimentation that do not put resources at risk will also be used in attempts to reduce uncertainty wherever appropriate.

Resolving Technical Conflicts—

Numerous technical conflicts threaten to prevent or hamper progress in reaching consensus on priority actions. Examples might include the nature of the Fish-X2 relationship or the role of habitat restoration in recovery of listed species. Mechanisms for resolving such technical conflicts are needed that focus the debate clearly on policy issues. One approach that might help to reach consensus would be to gather technical experts with opposing views on a given issue in a workshop setting for the express purpose of identifying specific, additional, directed efforts to collect additional data, perform additional experiments, or conduct new modeling exercises. The use of external reviewers to evaluate all existing information pertinent to a given issue might be another avenue.

Data Collection, Data Management, and Information Handling

Data Collection, Reporting and Management—Many agencies, organizations, and individual research scientists will be collecting data and providing these data and their interpretation to the MARO. It is not envisioned that the MARO will be managing all of this information, but it will have to set quality assurance guidelines, metadata standards, and reporting requirements. It will also

need to set guidelines for making data available and may need to assist some members of the CMARP Team with this task. A certain subset of the data will need to actually be managed by the MARO. Data management is discussed more fully in Chapter 5.

Likewise, it is not anticipated that all of the research needed for the program will be conducted within the MARO. It will be the intent of CMARP to make wide use of universities, non-governmental organizations and the private sector to actually propose and carry out individual research projects, or perhaps even larger-scale, multi-year research program elements. The amount of research conducted by the organization itself, as opposed to the entire CMARP Team will depend upon how large a scientific staff is created for the organization; nonetheless, this is an activity that can go on externally as well as internally.

Data Analysis and Interpretation—Turning the data into useful information products will be one of the most important functions of the MARO. While the MARO will be calling on numerous members of the CMARP Team to assist in this task, it is necessary to focus responsibility for the accomplishment of this task upon the MARO itself. Much of the initial analysis and interpretation may be conducted by CMARP Team partners responsible for the monitoring program, but MARO will have a more integrative responsibility. Monitoring is an expensive activity, so the more knowledge that can be derived from the monitoring the better. This means that individuals and small teams comprising experts in the relevant discipline who are familiar with exploratory data analysis and statistics, from either the Core Technical Staff or the broader CMARP team, should be commissioned to provide ongoing and/or periodic analyses of monitoring data. Further description of this process is provided in Chapter 5 of this report.

Communication of Findings—A necessary function of MARO will be providing the findings of monitoring, assessment and research programs to the Decision-making Body, to the stakeholders and to the public. Individual researchers of the CMARP team should be encouraged to communicate individual project findings, but this will not be sufficient. It will be necessary for the Decision-making Body to have help in identifying, assessing, and understanding the limitations of the best available information upon which decisions are based. It will need to direct reports targeted at all segments of the CALFED community to be prepared. It will also be necessary to provide periodic and understandable briefings for the Decision-making Body and the public on the implications of the work being done. Mechanisms for the reporting of real-time monitoring data and annual reporting of status and trends of indicators will also be needed. These communications will be built upon successful examples of existing reporting and communication.

Annual Science Conference—

Direct communication will be enhanced among scientists and managers, partnerships among participating organizations can be strengthened, which will also help build public credibility. All individuals and organizations that received funding through the MARO would be expected to participate and present their work. In addition, the Chief Scientist and others could discuss general direction of the science program, management implications of the findings coming out of the work and what is being learned about the condition of the system and the way it functions. This conference could be an annual opportunity to publicly present and explain how indicators are being used to assess “Bay-Delta Health” and what the indicators are telling us about trends in environmental condition. Such a conference might incorporate components of two existing

successful and popular events—The IEP Annual Meeting and the SFEI State of the Estuary Conference.

Stakeholder Advisory Mechanisms

Provision will be made for stakeholder participation in the Decision-making Body that approves the CMARP budget. Many stakeholder groups include people with considerable scientific expertise, whose contact with CMARP staff and contractor scientists will enhance the value of the program. Direct contact between scientists working for stakeholder groups and CMARP scientists should be encouraged. In addition, responsiveness of the overall program will depend upon the understanding of the Chief Scientist and the Science Coordination Team of the management questions that need to be addressed. A formal means, such as a Stakeholder Advisory Committee that is given the opportunity to communicate with the Chief Scientist concerning the prioritization of management questions and content of annual work plans prior to their review by the Decision-making Body would aid in this process. An alternate approach would be to include stakeholder representatives on the Science Coordination Team. Stakeholder-funded scientists should also be encouraged to communicate with and collaborate with CMARP-funded scientists on projects.

QUESTIONS TO RESOLVE IN DEVELOPING THE ORGANIZATIONAL STRUCTURE FOR A COMPREHENSIVE MONITORING ASSESSMENT AND RESEARCH PROGRAM

The basic elements discussed above will fit into any number of structures that might be formed for the overall governance of the CALFED program. There are a number of decisions concerning the institutional structure that the workgroup discussed, and which were proposed to those who were interviewed. Largely because of the uncertainty that exists concerning the

eventual structure for the overall CALFED program and its decision-making process, it was not possible to reach conclusions on some of these questions. The following questions represent areas where the views of reviewers would be most welcome.

What is CMARP's Relationship to

CALFED? CMARP has been described as the science arm of CALFED. This implies that the relationship between CMARP and CALFED is essentially a partnership. It is a partnership intended to promote science-based decision-making and an adaptive approach to managing the Bay-Delta System. We have, therefore, tried to describe elements of an organization that would both be accountable and responsive to CALFED, yet be able to carry out monitoring, assessment and research in a fairly independent manner. This is not the only relationship that could be established. It is possible to create a monitoring and assessment program that is imbedded within the CALFED Decision-making body and that only responds to specific tasks generated by program managers. It would also be possible to create a science program that was independently funded and therefore completely independent of the CALFED management structure.

To Whom or to what does CMARP

Report? Because it is not certain how the CALFED program in the future will carry out decision-making, it is difficult to suggest exactly whom the Chief Scientist and the rest of the CMARP institutional structure should report. Most workgroup members felt that the Chief Scientist should be hired by and attached to some organization such that he or she did not have to personally deal with all of the administrative functions that attend to grant-making and contract management. It is necessary to define a direct relationship between the Chief Scientist and the highest Decision-making Body of CALFED, including whether it is that body that is responsible for his or her hiring and firing. This is the only way that

CMARP can act as the science arm of the CALFED program, and act in partnership with CALFED in promoting an adaptive approach to managing the Bay-Delta system.

Some stakeholders felt strongly that the program should be closely attached to and responsive to an Ecosystem Restoration Authority. If the common programs are carried out as separate independent programs with different decision-making bodies, it cannot be housed within any of them and should be independent of any common programs.

What monitoring, research, and research functions should be centralized, and to what extent?

The original charge to IEP, USGS and SFEI was to design a program that addressed all of the common programs. That does not necessarily imply that one overall institutional structure should address all needs. A few of the stakeholders questioned felt strongly that CMARP should concentrate on the environmental questions, and not deal with issues such as water transfer and water efficiency. They expressed the view that these latter concerns should be monitored by different organizations from the one primarily concerned with ecosystem conditions. Many felt strongly that there should be a monitoring program created specifically to serve the needs of an Ecosystem Restoration Authority. Most of the workgroup felt that there would be benefits to having one comprehensive monitoring, assessment and research program. They argued that many of the common programs have interrelated and overlapping information needs, that activities proposed to promote the objectives of one common program might have adverse effects in others, and these need to be assessed comprehensively.

Is a new agency or organization needed to implement CMARP? A number of stakeholders queried believed strongly that

a new organization should be established. Workgroup members were divided on this point. It was felt by workgroup members that a new scientific culture needed to be established, and this would be easier to do with a new organization at the core of the effort. It could be accomplished with the inclusion of the position of Chief Scientist and a commitment to extensive external and peer review. Whether or not a new organization was formed at the core of CMARP, all felt that the collaboration among the larger CMARP Team was key to success of the overall program. If a new organization is set up, care should be taken to make this organization one that enhances, rather than competes with existing programs.